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5 Transition from a waveguide to a microstrip~~State of the Art~~  
1. field of invention

The ~~present~~ invention relates to a transition from a waveguide to a  
 and more particularly, to a  
 10 microstrip, wherein ~~the~~ microstrip extending on a substrate projects in  
 through an opening into ~~the~~ waveguide and a ground line associated ~~with~~ <sup>therewith,</sup>  
 the microstrip contacts the waveguide wall.

2. Description of the related art

~~Such~~ A transition from a waveguide to a microstrip is known from US  
 15 5,202,648. In <sup>wherein, a</sup> this connection, ~~the~~ <sup>is</sup> microstrip <sup>is</sup> extends <sup>on</sup> the upper side of  
~~the~~ <sup>an</sup> substrate and ~~the~~ <sup>an</sup> associated ground line, consists <sup>of</sup> of a conductive  
 surface on ~~the~~ <sup>an</sup> opposite <sup>side of the</sup> substrate ~~side~~ which contacts the waveguide wall.

A problem is that

1 One weak point of transitions between a waveguide and a contact strip  
 designed in this way <sup>has</sup> is a reflection attenuation <sup>that</sup> which is frequently too low  
 20 and ~~also~~ a transmission attenuation which is too high.

What is needed is

It is the underlying object of the invention to provide a transition, of the  
 kind first mentioned which has the highest possible reflection attenuation  
 and the lowest possible transmission attenuation.

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~~Advantages of the Invention~~Summary of the Invention

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<sup>A</sup>  
~~In accordance with claim 1, the ground line associated with the <sup>a</sup>microstrip includes~~  
~~consists of a plurality of ground surfaces superimposed on one another all of~~  
~~which all contact one another by means of through-contacts in the a~~  
~~substrate. The multi-layer ground line produces a more favorable field~~  
5 ~~conversion from the microstrip to the waveguide, thereby a high reflection~~  
~~attenuation and a low transmission attenuation arises for the transition.~~  
<sup>way</sup>  
<sup>Results</sup>

~~Advantageous further developments of the invention can be seen from the~~  
~~dependent claims.~~

10

~~Since a through-plating is provided in the substrate at the end of the~~  
<sup>which acts</sup>  
~~microstrip acting as an antenna and projecting into the waveguide, the~~  
<sup>which</sup>  
~~transition bandwidth becomes larger.~~ <sup>thus</sup> ~~is enlarged.~~

<sup>multi-layer</sup>  
15 ~~To be able to make a good contact between the ground line and the~~  
~~waveguide wall, it is expedient for ground surfaces to be applied to the~~  
<sup>on</sup>  
~~substrate at both sides next to the microstrip and for these ground~~  
<sup>thereof</sup>  
~~surfaces to be in contact with the other ground surfaces superimposed on~~  
<sup>that are</sup>  
~~one another in the substrate via through contacts (vias). Advantageously,~~  
20 ~~the substrate is fixed by at least one screw on a support on the waveguide~~  
~~wall with the screw being guided through the ground surface and~~  
~~electrical contact being made between these and the support.~~  
<sup>To the support</sup>  
<sup>ground surfaces</sup>

<sup>by way of</sup>  
A low transmission attenuation is achieved ~~in that~~ <sup>by way of</sup> at least one screw having  
25 ~~lies with its head on one of the ground surfaces~~ <sup>which is</sup> ~~applied to the upper side of the~~  
~~substrate, side at the side next to the microstrip and in that a conductive~~  
<sup>by way of</sup>  
~~ribbon, which is connected to the waveguide wall, is clamped between the~~  
<sup>that</sup>  
~~screw head and the ground surface. Alternatively, to this, at least one~~  
<sup>the conductive ribbon being</sup>

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conductive elastic body <sup>is</sup> ~~each~~ be inserted between one of the two ground surfaces located to ~~the~~ <sup>each</sup> side of the microstrip and a projection of the waveguide wall projecting over the ground surfaces. ~~Moreover,~~ <sup>Further</sup> a conductive elastic body can be pressed ~~in~~ between the head of the at least one screw and the projection of the waveguide wall.

## Drawing

10 The invention will be described in more detail in the following with reference to a plurality of embodiments shown in the drawing. There are shown:

Figure 1 a perspective illustration of a transition from a waveguide to a microstrip;  
 Figure 2 a longitudinal section A-A through the transition; and  
 Figure 3 a cross-section B-B through the transition.

20 ~~Description of embodiments~~

### Detailed Description of the Invention

Referring now to the drawings, and more particularly to

As can be seen from the perspective schematic diagram in Figure 1, ~~a~~ <sup>there is illustrated</sup> a microstrip 2 ~~extends~~ on a multi-layer substrate 1. ~~An~~ <sup>an</sup> opening 4 is located in a side wall of ~~a~~ waveguide 3 and ~~a~~ tongue 5, <sup>located at the</sup> ~~located at the~~ substrate 1, projects through it into the waveguide 3. The <sup>Portion</sup> ~~end~~ of the waveguide 2 which <sup>Microstrip</sup> ~~extending~~ on the tongue 5 ~~acts as~~ <sup>is</sup> an antenna 6 for coupling the which couples a waveguide field to the microstrip and/or vice versa.

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Now, Additionally referring to

there is shown

~~As shown in more detail in Figures 2 and 3~~ two ground surfaces 7 and 8, which are applied to the upper <sup>side of</sup> substrate <sup>1</sup> side next to the microstrip 2 and, in addition, a plurality of ground surfaces 9 are superimposed on one another within the multi-layer substrate <sup>1</sup> and <sup>each</sup> <sup>inf</sup> have the same ground potential.

- 5 ~~The~~ Cross-section B-B, through the waveguide 3 into the substrate 1, shown in Figure 3 shows the multi-layer ground surfaces 9 within the substrate 1.

- 10 ~~The~~ longitudinal section A-A, shown in Figure 2, shows the two symmetrical ground surfaces 7 and 8, <sup>respectively along each</sup> at both sides of the microstrip 2. These ground surfaces 7 and 8, on the upper <sup>side of</sup> substrate <sup>1</sup> side are connected in an electrically conductive manner by a plurality of through-contacts 10 to <sup>which are</sup> other ground surfaces 9 superimposed on one another within the substrate 1. The positions and spacings of the through-contacts 10 are
- 15 selected such that a field propagation into the intermediate areas between the ground surfaces of the multi-layer substrate 1 is prevented, since the function of circuits, arranged in the individual substrate layers, could be thereby interfered with.

- 20 The ground surfaces 9 of the substrate 1, preferably project some tenths of a millimeter into the waveguide 3, <sup>thereby</sup> in order to increase <sup>ing</sup> the positional tolerance of the substrate 1 with respect to the waveguide 3. The field configuration beneath the microstrip 2 in the waveguide 3 closely depends on the position of the ground surfaces 9. If the position of the substrate 1
- 25 is ~~now~~ slightly changed, ~~then~~ the field remains unchanged due to the positional tolerance of the ground surfaces 9. At an operational frequency of, for example, 10 GHz, a penetration depth of the ground surfaces 9 into the waveguide 3 of 0.5 - 1.0 mm is appropriate.

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~~The~~<sup>11</sup> multi-layer substrate 1 forms a larger virtual ground, whereby a field configuration arises which is better transformed into a waveguide wave. The field is ~~namely~~ shaped more intensely into a field component of the fundamental wave type of ~~the waveguide~~<sup>3</sup> by the larger expansion of the ground (due to the many ground surfaces<sup>9</sup> stacked on top of one another) in the direction of the broad side of ~~the waveguide~~<sup>3</sup>.

It can be seen from Figures 2 and 3 that a through<sup>plating</sup> 11 is provided at the end of ~~the antenna 6 of the microstrip 2~~ extending on ~~the substrate tongue 5~~. This ~~Through~~<sup>plating</sup> 11 at the end of ~~the antenna 6 of the microstrip~~<sup>2</sup> results in a broadening of the frequency band of the transition from ~~the waveguide 3 to the microstrip 2~~. The ~~Through~~<sup>plating</sup> ~~contact~~<sup>11</sup>, at the end of ~~the antenna 5~~, ~~also becomes~~<sup>15</sup> larger due to the thicker design of the substrate 1, which contributes to a more favorable conversion of the microstrip field into the waveguide field.

~~The~~<sup>4</sup> Substrate 1 is fixed to a ~~Support 14~~ beneath ~~the Opening~~<sup>14</sup> ~~and starting from the waveguide wall by means of at least one screw, there being~~ ~~are~~ two screws 12 and 13 in the embodiment shown in Figure 2. In this connection, the Screws 12 and 13 lie with their heads on ~~the ground surfaces 7 and 8~~ applied to the side next to ~~the microstrip 2~~ and ~~thus screws 12 and 13~~ make an electrical contact between ~~the ground surfaces 7 and 8~~ and ~~the ground surfaces 9~~ superimposed on one another in ~~the substrate 1~~ and ~~the waveguide wall 14~~. Since <sup>electrical</sup> ~~a~~ contact is additionally made between ~~the ground lines 7 and 8~~, applied to the upper side of ~~the substrate 1~~, and ~~the waveguide wall~~<sup>14</sup>, the transmission attenuation of the transition is reduced. This contact can, as shown in Figure 2, be made by two conductive

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ribbons 15 and 16, which are clamped at one end between the heads of the screws 12 and 13 and the conductive surfaces 7 and 8 and at their other end in the parting plane 17 of the waveguide 3, <sup>including</sup> consisting of two half shells.

5

effecting

and

Figure 3 shows another variant for <sup>effecting</sup> the contact of the ground surfaces 7 and 8 <sup>and</sup> and screws 12 <sup>and</sup> 13 <sup>electrical</sup> with the waveguide wall <sup>14</sup>. Here, the waveguide 3 has a wall projection 18 above ~~the~~ opening 4 which projects over the ground surfaces 7 and 8 on the upper side of the substrate 1. One or more

10 conductive elastic bodies 19 are clamped between the ground surfaces 7 and 8 on the upper <sup>side of</sup> substrate <sup>1</sup> side and the wall projection 18. One or more conductive elastic bodies 20 can also be pressed between the heads of the screws 12 and 13 and the wall projection 18.

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